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A NEW FORM OF *SOLANUM* FRUIT

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Abstract

In two northern Australian species of *Solanum* the usual berry fruit has been modified to form a censer with wind ballist seed dispersal. The fruit structure and dispersal mechanism are described and compared with similar fruits in other groups.

Most texts describe the fruit of *Solanum* species as berries, "a pulpy fruit with immersed seeds". Variations on this form of fruit occur and several are mentioned in my paper Symon (1979) on fruit diversity and dispersal in *Solanum* in Australia. Brief mention was made there of an unnamed species from Kalumburu in the Kimberleys of Western Australia. The tall willowy plant was illustrated and later described as *S. tudununggae* (Symon 1981). The plant has been grown in cultivation and after hand pollination of the females a number of fruits were set. Figure 1 shows three fruits at maturity, the centre one with the calyx cut away to show the dried shrunken berry not yet separated; the left hand one shows the fruit circumscissile towards its base, released within the calyx tube from which it is not free to fall, but where it forms a loose plug. From the orifice of the calyx tube the seeds may then be shaken out. The free cap is broadly conical, thin and papery at the point of rupture, the apex relatively thick and firm. There is no indication of what process brings about the rupture, but it is probably the shrinkage of the cap with its solid apex relative to the base, which pulls the cap from its base on drying. The massively thickened apex of the berry tapers away to the point of abscission. A sketch of both longitudinal and transverse sections of a mature fruit are shown in Figure 2. The transverse section is typical of many *Solanum* fruits.

The berry is broadly adherent to the calyx at its base. No septum divides the berry when ripe, but a trace of the disintegrated septum is visible lining the cap. The placenta is deeply divided into two lobes the bases of which are several millimetres apart. The three fruits illustrated contained 172, 199 and 235 seeds, many of which are borne right at the base of the placenta and between the lobes so that they are well below the level of the rupture zone.

Since *S. tudununggae* was collected and grown, Mr K. Kenneally has re-collected *S. vansittartensis* first described by C.A. Gardner in 1923. Although very different in leaf form to *S. tudununggae* this species also has a similar slender growth habit and fruit. The fruits are a little larger than those of *S. tudununggae* but identical in basic structure. The calyx wall is somewhat tougher and certainly more prickly, the apex of the fruit after shedding also being rather thick and firmer. The fruit is illustrated in Figure 3.

The seeds of the two species are very similar being c. 2.5 mm long, subreniform, flattened, minutely reticulate and black. In both species the fruits are held close to the stem at an angle of about 45° on short, thick pedicels. This is a censer mechanism for seed dispersal and the tall willowy growth habit is effective in scattering the seeds in the vicinity of the plant. One imagines the mechanism operates best under gusty, windy conditions; a wind ballist method of seed dispersal.

Both of these species are restricted in distribution to the northern parts of the Kimberleys region on the Mitchell Plateau and the vicinity of Kalumburu. Both occur on areas of dissected sandstone tableland and both may be annuals or biennials, but their life

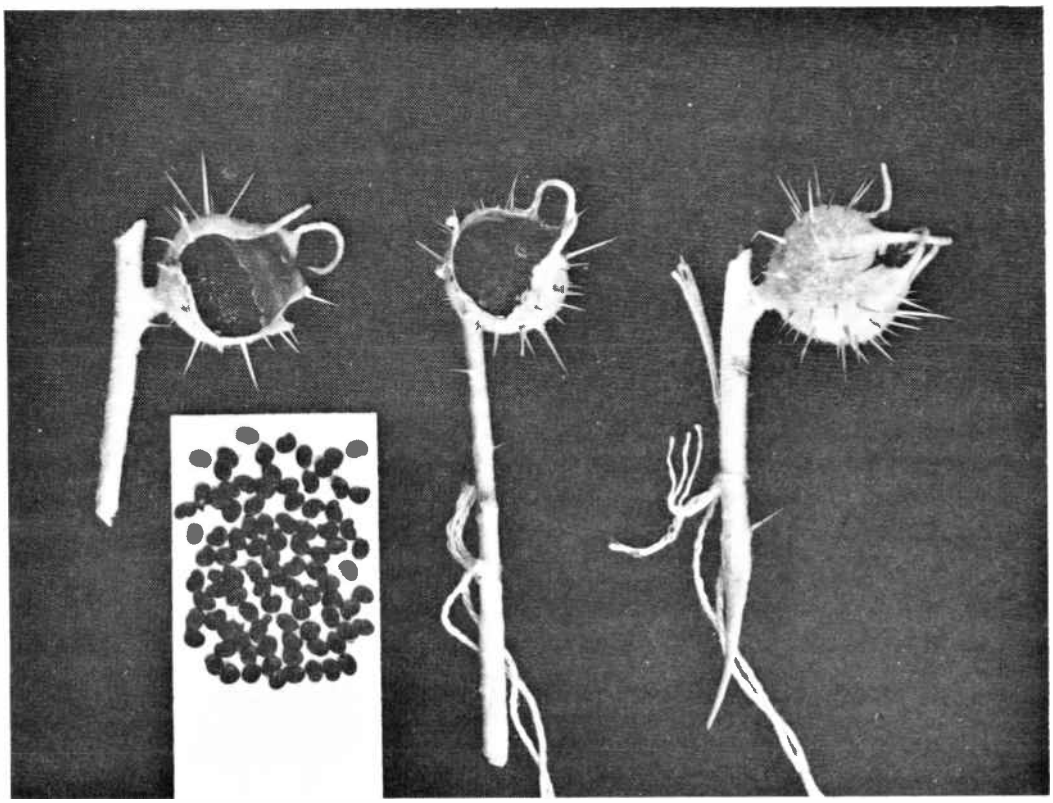

Fig. 1. Mature fruits of *S. tudununggae*. On left: calyx cut away to show loose cap within the calyx and some of the seeds; in the centre: calyx cut away to show the cap still attached; on the right: intact fruit.

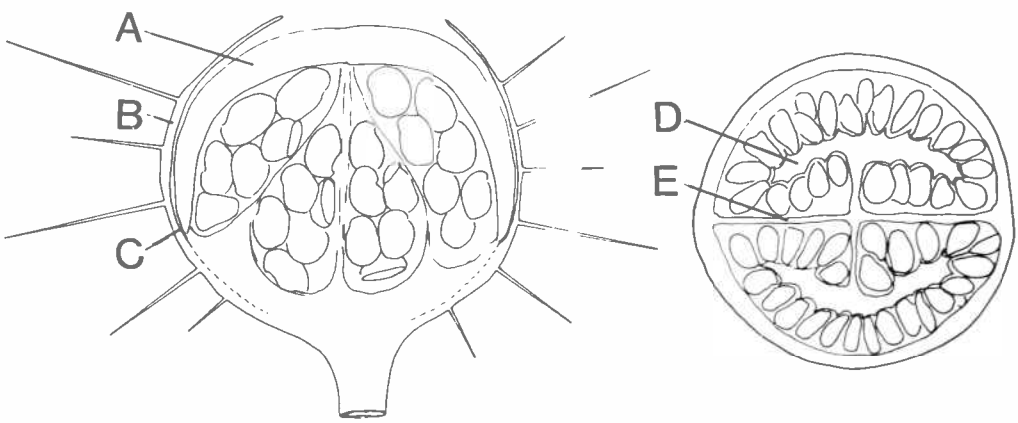

Fig. 2. Tangential longitudinal section and transverse section of fruits of *S. tudununggae*. A: thickened apex of the berry; B: enveloping calyx; C: zone of abscission; D: placenta; E: septum.

cycle is inadequately known. Both belong to the group of dioecious species which are almost restricted to the north west of Western Australia. Considering the small size of the group the range of fruit types is remarkable, see Table 1.

Table 1. Fruit type in dioecious species of *Solanum*

Species	**Fruit type**
S. asymmetriphyllum	succulent berry
S. dioicum	mucilagenous berry
S. cunninghamii	mucilagenous berry
S. carduiforme	berry
S. petraeum	bony-walled berry
S. leopoldensis	bony-walled berry
S. tudununggae	censer
S. vansittartensis	censer
S. cataphractum	unknown

Some species of *Solanum* with dry subcapsular fruits are known, e.g. Section Androceras. The most widespread species, *S. rostratum* Dunal (buffalo burr), has a berry tightly enclosed within the adherent, prickly calyx tube. At maturity, both the calyx tube and the now dry berry rupture to form a cup-like structure containing the dry seeds and their release is mediated by wind, rain or other movement (Whalen 1979). The plants are essentially short and sturdy and the seeds 'spilt' rather than shaken out. The structure of the berry and plant habit are radically different in the Australian species.

Before maturity, a berry and a capsule may not differ greatly in essential structure. The ripe berry is usually succulent with seeds immersed in moist flesh which rarely ruptures. In those cases where it does, e.g. *Momordica balsamina* L., the ruptures are irregular and the seeds are enveloped in red flesh and thus become available for dispersal. The fruit of *Datura inoxia* Mill. breaks irregularly, is somewhat mealy in character, and the seeds bear an elaiosome and are available for secondary dispersal.

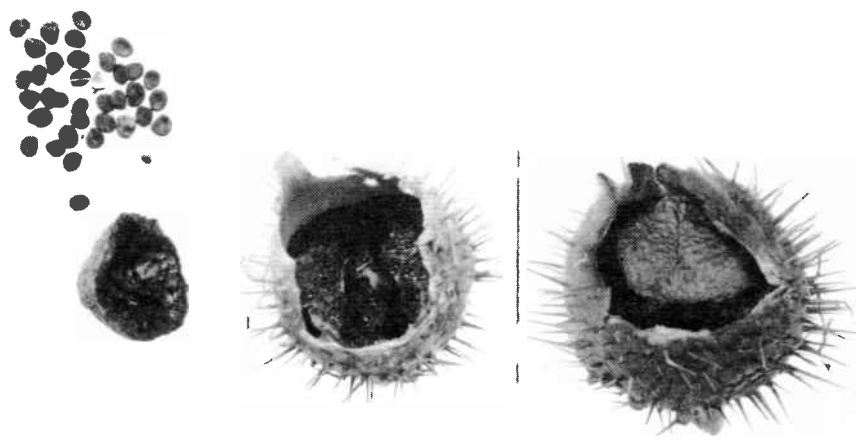

Fig. 3. Mature fruits of *S. vansittartensis*. On left: seeds and cap; in the centre: broken calyx showing dried placenta and zone of fracture; on the right: mature fruit with calyx cut away to show cap in position.

Capsules are dry at maturity and usually rupture along defined sutures, e.g. *Nicotiana* species; others have apical pores, e.g. *Papaver* species. In none of these is the calyx an essential part of the mechanism, though some capsules may be substantially enclosed in the calyx, e.g. *Nicotiana*. In capsules which split open the sutures are usually longitudinally oriented, e.g. most Scrophulariaceae. In the more specialised examples apical pores have developed, e.g. *Papaveraceae*. Circumscissile dehiscence is less common but may be seen in *Hyoscyamus niger* L. (hen bane) where a cap-like apex is shed and the seeds released. In this species the capsule is substantially protected by a spinescent calyx but the cap is not retained within the calyx. The mechanism of dispersal described for the two Australian species of *Solanum* would thus appear to be modification of a berry fruit not previously reported.

Acknowlegement

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